<u>WHAT IS CLAIMED IS</u>:

1. A process for depositing a film on a substrate disposed in a processing chamber, said process comprising the steps of:

(a) introducing a process gas into said process chamber;

(b) applying RF power to an inductively coupled coil to form a plasma from said process gas and deposit a first layer of said film over said substrate during a first time period;

(c) maintaining said plasma during a second time period subsequent to said first time period and biasing said plasma toward said substrate to promote a sputtering effect of said plasma and deposit a second layer of said film over said first layer.

2. The process of claim 1 wherein said biasing step is performed by applying RF power to capacitively coupled electrodes.

3. The process of claim 1 wherein said second time period is at least 10 times longer than said first time period.

4. The process of claim 1 wherein said process gas comprises silicon and oxygen and said deposited film is a silicon oxide film.

5. The process of claim 4, wherein said silicon oxide film is deposited at a temperature of between about 200-425 °C.

6. The process of claim 4, wherein said silicon oxide film is deposited at a pressure of between about 1-25 millitorr.

7. The process of claim 4, wherein said silicon oxide film is deposited at a temperature of between about 375-400°C and at a pressure of between about 4-7 millitorr.

8. The process of claim 2, wherein the application of RF power to said capacitively coupled electrodes is delayed between about 1 to 100 seconds while the application of RF power to said inductively coupled coil is maintained.

9. The process of claim 8, wherein the application of RF power to said capacitively coupled electrodes is delayed between about 5 to 20 seconds while the application of RF power to said inductively coupled coil is maintained.

10. The process of claim 1, wherein said first layer is deposited to a thickness of between about 1 to 15 percent of the thickness to which said second layer is deposited.

11. The process of claim 1, wherein said film is about 1.0 microns or less and said first layer is about 0.15 microns or less thick.

12. The process of claim 1 wherein said process gas comprises silane and oxygen.

13. The process of claim 12 wherein said process gas further comprises argon.

14. In a high-density plasma chemical vapor deposition chamber having an inductively coupled coil and capacitively coupled electrodes, a process for depositing a film on a substrate, said process comprising the steps of:

(a) introducing a process gas into said chamber;

(b) applying RF power to said inductively coupled coil to form a plasma from said process gas and deposit a first layer of said film over said substrate;

(c) maintaining said inductively coupled plasma and applying RF power to said capacitively coupled electrodes to bias said plasma toward said substrate, thereby promoting a sputtering effect of said plasma and depositing a second layer of said film.

15. The process of claim 14 further comprising the steps of:

(d) maintaining said inductively coupled plasma and removing RF power from said capacitively coupled electrodes to stop biasing said plasma toward said substrate and deposit a third layer of said film over said substrate;

(e) maintaining said inductively coupled plasma and applying RF power to said capacitively coupled electrodes to bias said plasma toward said substrate, thereby promoting a sputtering effect of said plasma and depositing a fourth layer of said film;

(f) repeating steps (d) and (e) iteratively until a selected thickness of said film is reached.

16. An integrated circuit formed on a semiconductor substrate by the method of claims 1, 14 or 15.

17. A high-density plasma chemical vapor deposition system comprising:

a housing for forming a vacuum chamber;

a vacuum pump for evacuating said vacuum chamber;

a pedestal, located within said housing, for holding a semiconductor substrate;

a gas distribution system for introducing a process gas into said vacuum chamber;

a plasma generation system for creating an inductively coupled plasma from said process gas within said vacuum chamber and for biasing said plasma toward said substrate to enhance sputtering;

a controller for controlling said vacuum pump, said gas distribution system and said plasma generation system;

a memory coupled to said controller and storing a program for directing the operation of said system, said program including a set of instructions for depositing a stress-reduced film by

first, controlling said gas distribution system to introduce said process gas into said chamber;

second, controlling said plasma generation system to apply RF power to said inductively coupled coil to form a plasma from said process gas and deposit a first layer of said film over said substrate; and

third, controlling said plasma generation system to maintain said inductively coupled plasma and bias said plasma toward said substrate, thereby promoting a sputtering effect of said plasma and depositing a second layer of said film.

18. The apparatus of claim 17 wherein said program further includes instructions for depositing a plurality of said first layers and said second layers by

fourth, controlling said plasma generation system to maintain said inductively coupled plasma and stop biasing said plasma toward said substrate;

fifth, controlling said plasma generation system to maintain said inductively coupled plasma and bias said plasma toward said substrate, thereby promoting a sputtering effect of said plasma; and

sixth, performing the second and third steps iteratively at least once until a desired thickness of said film is reached.

19. The apparatus of claim 17 wherein said gas distribution system is adapted to introduce a process gas comprising silicon and oxygen into said chamber.

20. A high-density plasma chemical vapor deposition system comprising:

a housing for forming a vacuum chamber;

a pedestal, located within said housing, for holding a semiconductor substrate;

means for introducing reactants into said vacuum chamber, said reactants including silicon and oxygen;

means for generating an inductively coupled plasma from said reactants to deposit a first layer of a silicon oxide film on said semiconductor substrate during a first time period, said first layer for the reduction of mechanical stress in a subsequently deposited layer of a silicon oxide film; and

means for biasing said plasma toward said substrate during a second time period after said first time period to enhance a sputtering of said plasma and deposit said subsequent layer.

21. The apparatus of claim 20, further comprising means for maintaining a pressure of between about 0.001-10 torr in said vacuum chamber while said films are deposited.

22. The apparatus of claim 20, further comprising means for maintaining a wafer temperature of between about 100-500 °C in said vacuum chamber while said films are deposited.

23. An integrated circuit formed on a semiconductor substrate, said integrated circuit comprising:

(a) a plurality of active devices formed in said semiconductor substrate;

(b) at least one metal layer formed above said semiconductor substrate; and

(c) at least one insulating layer formed between said metal layer and said semiconductor substrate, said insulating layer having a plurality of patterned holes filled with electrically conductive material to electrically connect selected portions of said metal layer to selected portions of said semiconductor substrate, wherein said insulating layer comprises a first silicon oxide layer and a second silicon oxide layer, said first and said second silicon oxide layers deposited using a high-density plasma chemical vapor deposition process, said first silicon oxide layer deposited for the reduction of mechanical stress in said second silicon oxide layer.

24. The integrated circuit of claim 23, further comprising:

(d) a second metal layer formed above said semiconductor substrate and below said at least one insulating layer;

(e) a second insulating layer formed between said second metal layer and said semiconductor substrate, said second insulating layer having a second plurality of patterned holes filled with electrically conductive material to electrically

connect selected portions of said second metal layer to selected areas of said plurality of active devices.

add B3